Harding Lawson Associates

REVISED WORK PLAN
Assessment of Emerging Chemicals in the Vadose Zone, Aerojet Azusa Facility, San Gabriel Basin, California

Engineering and Environmental Services

HLA

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Assessment of Emerging Chemicals in the Vadose Zone, Aerojet Azusa Facility, San Gabriel Basin, California

Prepared by HLA on Behalf of:

Aerojet Corporation

HLA Project No. 46716

David M. Johnson

David M. Johnson, RG 6731
Associate Geologist

D M. Johnson / for -

Grant L. Ohland, RG 4678, CHG. 348
Principal Hydrogeologist

April 14, 2000

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Harding Lawson Associates
Engineering and Environmental Services
2171 Campus Drive, Suite 100
Irvine, CA 92612 — (949) 260-1800

Harding Lawson Associates

April 14, 2000

Mr. Ejigu Solomon
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, California 90013

Subject: **Submittal of Revised Work Plan**
Assessment of Emerging Chemicals in the Vadose Zone
Aerojet Azusa Facility
San Gabriel Basin, California

Dear Mr. Solomon:

Transmitted herewith is a revised work plan for assessment of 'emerging chemicals' at the Aerojet Azusa facility, San Gabriel Basin, California (site). This work plan has been revised based on comments received from the California Regional Water Quality Control Board, Los Angeles Region (Regional Board), in letter dated March 14, 2000. Also included with this revised work plan is a Response to Comments letter (dated April 13, 2000), that reflects our response to the Regional Board's comment letter and sets out how this work plan has been revised accordingly. This revised work plan is submitted pursuant to Cleanup and Abatement Order No. 99-073, issued by the Regional Board on November 24th.

We call your attention to two changes that are reflected in this revised work plan. First, so that Aerojet may better manage the costs associated with this investigation, we have proposed a two-phased approach to field implementation. The scope and timing of the second phase will be determined in conjunction with the RWQCB, based on results from the first phase. Second, we believe it is appropriate to base our deep drilling/sampling program on results brought forth from shallow-interval samples. Therefore, performing deep-interval borings will be contingent on shallow-interval test data.

We trust this information is satisfactory to your current requirements. We remain committed to working with the RWQCB to carry through with our assessment of the site.

Sincerely,

David M. Johnson

David M. Johnson, RG No. 6731
Associate Geologist

D. M. Johnson /for-

Grant L. Ohland, CHG No. 384
Principal Hydrogeologist

Cc: John Catts, HLA
Don Vanderkar, Aerojet

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1.0 INTRODUCTION

This document presents a revised work plan for assessment of 'emerging chemicals' at the Aerojet Azusa facility, San Gabriel Basin, California (site). This document has been revised based on comments received from the California Regional Water Quality Control Board, Los Angeles Region (Regional Board), in letter dated March 14, 2000. Included with this revised work plan is a Response to Comments letter that reflects our response to the Regional Board's comment letter and sets out how this work plan has been revised accordingly. This document is submitted pursuant to Cleanup and Abatement Order No. 99-073, issued by the Regional Board on November 24th, 1999. This document has been prepared by Harding Lawson Associates (HLA) on behalf of Aerojet. This work plan presents the background to the investigation, establishes the objectives, and sets forth the means by which this investigation will be accomplished.

The site encompasses properties currently or formerly held by Aerojet. However, it should be noted that at various times in the past other potentially responsible parties (PRPs) have occupied portions of the site. Among these other potentially responsible parties, several are known or suspected to have handled or used the emerging chemicals identified in the Regional Board Order. These other potentially responsible parties include Optical Radiation Corporation (ORC), Day and Night Corporation, Reichold Chemical, and Oil Solvent Recycling Company (OSCO). This work plan addresses property held by these other potentially responsible parties and Aerojet. The remainder of this work plan presents the background and objectives for the assessment of emerging chemicals, describes an investigative approach, identifies potential source areas, presents drilling and sampling methods, and an implementation schedule.

1.1 Background and Objectives

The term 'emerging chemicals' refers to three chemicals of concern that were recently detected in groundwater in the region surrounding the site. These new chemicals of concern are: perchlorate, N-nitroso dimethylamine (NDMA), and 1,4-dioxane. Perchlorate is an inorganic ion (i.e., a salt), while the other two compounds are semivolatile organic chemicals. These chemicals were not included in the previous vadose zone soils investigations that have been performed at the site. Therefore, the existence or locations of sources of these chemicals to groundwater are presently unknown.

Accordingly, and in response to Board Order No. 99-073, the objective of this work plan is to provide a plan for investigating and assessing possible source areas for these emerging chemicals in vadose zone soils underlying the site.

2.0 INVESTIGATIVE APPROACH

Perchlorate is associated with fertilizers, fireworks, metal processing flares, solid rocket motor development, and similar processes. Known uses of perchlorate at the site include manufacturing of photo-flash bombs and flares at the Day & Night Manufacturing Company facility (Day & Night), and the manufacture and testing of solid rocket motors by Aerojet. Perchlorate was used as an oxidizing additive in both processes. NDMA is associated with a variety of processes including rubber manufacturing, wastewater and drinking water treatment, food processing, beer production, and liquid rocket fuel development. NDMA most commonly occurred as an impurity in, or a by-product of, the fuel mixture unsymmetrical dimethylhydrazine (UDMH). 1,4-dioxane was an industrial solvent and most commonly used as a stabilizer in 1,1,1-TCA.

The approach to this investigation was therefore to evaluate the historic areas at the site where flares and flash bombs and rocket fuel chemicals were produced, used, tested or where these chemicals could otherwise come into contact with the environment. This work plan also focuses on areas at the site where the solvent 1,1,1-TCA was used or stored. To do this, HLA utilized previous reports that identified and described historical operations at the site, reviewed historical aerial photographs of the site, and where possible interviewed personnel with knowledge of the historical operations and chemical usage. From these efforts, a listing was compiled of the areas at the site where the subject chemicals would have the highest likelihood of contact with the environment. Sampling and assessment of these areas comprises the investigation that is described in this document.

2.1 Previous Investigations

It is important to point out that a considerable amount of environmental investigation has already taken place at the site and throughout the surrounding vicinity. These prior investigations have generally been associated with the Regional Board's Well Investigation Program of organic chemical contamination in area groundwater. The site is situated in what is called the Baldwin Park Operable Unit (BPOU) of the San Gabriel

Valley Groundwater Basin Superfund Site, as overseen by the US Environmental Protection Agency. At the site previous investigations have included numerous soil test borings, soil-vapor investigations, and periodic groundwater sampling. The previous efforts have included extensive examination and description of the historic operations at the site as pertains to potential environmental impact.

Although there have been considerable previous environmental characterization efforts in both soil and groundwater, the emerging chemicals perchlorate, NDMA and 1,4-dioxane were only first detected in 1997. To date, there have been no investigations for these chemicals in vadose zone soils anywhere in the area. This investigation represents the first attempt at assessing these chemicals in soils, with the objective of locating possible source(s) of these contaminants to the affected groundwater.

With these factors in mind, the previous investigations do provide a remarkably comprehensive historical database on the site, and substantive data regarding the likely locations where these chemicals could have come into contact with the environment. Detailed information regarding the historic manufacturing operations that occurred at the Aerojet site, along with descriptions of the current and historic buildings and infrastructure were previously investigated and are presented in these documents. It is this body of information that has provided the basis for this work plan. The reports which contain the most relevant and complete summary of the site history regarding the emerging chemicals include the following documents:

1. Harding Lawson Associates, September 1991, *Revised Work Plan, Azusa/Irwindale Study Area Site Assessment, San Gabriel Valley, California.*

2. Harding Lawson Associates, September 1994, *Comprehensive Site Assessment Report, Azusa/Irwindale Study Area Site Assessment, San Gabriel Valley, California.* Volumes I and II.

3. Aerojet aerial photograph archive; years covering 1940's through 1990's.

2.2 Site History Overview

According to the information reviewed, most of the operations that are now viewed as being of significance with regard to the emerging chemicals had ceased to exist at the site by the late 1950's. Therefore, to determine the locations where those operations took place, and therefore to determine where this investigation should focus in terms of sample locations, required a review of site history operations. The following section provides an annotated, general chronological history of site operations relevant to the emerging chemicals. More detailed descriptions of the historic site operations are presented in HLA (1991).

In reviewing the history of the site, it is important to note that Aerojet occupancy of the site has changed and evolved over the years. The Aerojet facility as it currently exists occupies a smaller portion of the site that historically existed. At its peak, the Aerojet facility covered an area of approximately 125 acres. Over the years however, the site has held numerous other commercial occupants that have conducted manufacturing or related industrial operations. In fact, in prior years some of the buildings that are within the current Aerojet facility have been leased to other business tenants. For example, Building 57 has been leased to a wide variety of tenants for the purposes of storage of building materials, warehousing, and manufacturing of bed springs. Building 119 was previously leased to the Ioptex Corporation, Building 159 was leased to ORC, and Building 163 was leased to the Johnston Pump Company. Properties west of Central Avenue (now called "Aerojet Avenue") were leased to Reichold Chemical Company and ORC. Other properties in the far western portion of the site were acquired by the City of Irwindale Community Redevelopment Agency (CRA). Currently, properties within the site include office, light industrial, and research and development operations.

Prior to 1943

The Aerojet Engineering Corporation was incorporated in March 1942 to accelerate and augment jet propulsion research and development being carried out at that time by the Guggenheim Aeronautical Laboratory Group of the California Institute of Technology. The company was organized to develop and produce jet propulsion devices. The company was established in Pasadena, California, and although the company was incorporated in March 1942, no machine shop equipment was available at the Aerojet Azusa plant until the middle of 1943.

At that time, Day & Night was located directly west of the original leased property occupied by Aerojet. The Day & Night facility extended west to Irwindale Avenue. As noted earlier, this facility produced and tested military photo-flash bombs at the site, utilizing perchlorate (one of the emerging chemicals) for that

purpose. Records indicate that Day & Night followed federal procedures in the handling and disposal of perchlorate, including flushing residues to ground with water and burning waste materials on the ground and flushing away the residue.

1943 to 1947

Beginning in 1943, a 49-acre portion of the site was developed and used by Aerojet for mixing solid propellants and testing rocket motors. Historical information indicates that some space may have been rented from the contemporaneous Day & Night facility west of the Aerojet-leased property. In 1946, land adjacent and east of the Aerojet-leased facility was purchased from Azusa Foothill Citrus Company. Property north of the Aerojet facility was leased on a month-to-month basis from Consolidated Rock Company in May 1947 for burning small quantities of waste solid propellant. In addition, a buffer strip on the south side of the Aerojet facility was leased from Azusa Rock & Sand in 1947.

The types of facilities rented or constructed by Aerojet generally were office, laboratory, materials storage, and test area buildings of simple construction. Solid and liquid propellant rocket research, development, and production operations took place at the facility. Initial rocket development and testing operations took place in the north central portion of the site, and development of an area called the "Proving Grounds" in the southeast portion of the site began soon after site occupancy in 1943. The term "Proving Grounds" has been used by Aerojet to identify an area occupied by rocket equipment test stands and associated buildings. By 1947, substantial development of the Aerojet facility had taken place, with many buildings completed, including several Proving Grounds, test stands with support buildings, the small ring channel (the large ring channel was under construction), and other facility improvements.

The primary chemicals used in onsite operations during this period were the components of rocket fuel. Solid rocket fuels consisted of a petroleum based (e.g., asphalt and motor oil fuel) binder material and oxidizers such as ammonium or potassium perchlorate. The liquid fuels consisted of an oxidizer (usually red fuming nitric acid or nitrogen tetroxide) and a fuel (such as aniline, furfuryl alcohol, or petroleum derivatives). Chemical and material storage was in bunkers for potentially explosive materials, and in drums or smaller containers in designated areas. Documentation indicates that the only waste disposal by Aerojet onsite or in nearby areas was the open burning of solid rocket fuel wastes. Excess liquid propellant materials were reportedly returned to manufacturers in their original containers.

Stormwater runoff was by gravity in historical natural channels or manmade open ditches. Other liquid wastes were managed via leach pits (for laboratory and other wastes) and leach beds (for rainwater and other uncontaminated waters), and septic tanks with leach fields (for sewage) at various locations around the site.

With regard to operations during this historical time period, areas of concern for inclusion in this assessment include drum storage areas, mixing areas, offsite drainage pathways, a propellant burn area, identified leach pits, leach beds, ponded liquid areas that would have utilized or otherwise been exposed to the fuel chemicals, and chemical storage bunkers associated with Day & Night.

1948 to 1953

The original facility leased by Aerojet from 1943 through 1947 was purchased by Aerojet in 1948 from the U.S. Government Reconstruction Finance Corporation. Property west and northwest of this Aerojet property was leased from E.K. Metzner in 1949. Additional acreage to the south was purchased from Davis Realty Company in 1950.

Rocket-fuel related chemicals continued to be used onsite. Construction of office, laboratory, materials storage, and Proving Grounds facilities for rocket motor research and development continued. By 1953, the Proving Grounds had been substantially developed. The research laboratories and propellant storage facilities in the center of the site (i.e., between the historical Central and West Avenues) were essentially complete, major new office (including Building 59) and manufacturing buildings (including the Building 57 machine shop) were complete, support facilities such as Buildings 118, 119, and 142 were in place, and the bunkered magazines (referred to as the "Special West Area") were constructed west of West Avenue for storage of explosives.

During this period, the population of the Los Angeles area expanded into the San Gabriel Valley. In an effort to find a more remote area for rocket motor production and testing, Aerojet purchased 7,300 acres of property east of Sacramento in 1950. Relocation of liquid and solid rocket motor operations from Azusa to Sacramento began in 1951.

Of particular importance to the facility in terms of infrastructure development was the 1952 completion of the industrial waste treatment/sewer system serving the majority of the Aerojet facility as it existed then. The onsite treatment plant discharged via pipeline to an industrial sewer under Irwindale Avenue. Efforts to develop this system had begun in 1949; however, a permit to discharge into the industrial line was not obtained until 1952.

Water runoff from open areas of the facility continued to be managed by local infiltration in open areas, and by gravity drainage (by natural or manmade channels) to leach ponds. Runoff from operational areas was managed via the industrial waste collection and treatment system after 1952. Burning of solid rocket propellant waste in the gravel pit (Kincaid Pit) at the northwest corner of the site continued during this time frame.

1953 to 1958

Transfer of rocket production and testing operations from Azusa to Sacramento was completed in 1958. Rocket motor and propellant research and development continued, but on a much reduced scale than in previous years. The Aerojet-occupied property expanded to the northwest and southwest (to Irwindale Avenue) through leases from E.K. Metzner, to the south with purchases from Azusa Rock & Sand, and to the east with purchases of small residential lots.

Facility growth emphasized expansion and new construction of office space, research labs, and manufacturing buildings. Upgrading of additional facilities was also significant. Building 159, now occupied by Optical Radiation Corporation, and Building 163 were built in 1957 to support the fiberglass and composite materials structure manufacturing operations. The number of laboratories, etc., connected to the industrial sewer continued to increase through this period. A sanitary sewer system, which replaced historical septic tanks, was constructed in 1956-1957. Most septic tanks and leach pits were taken out of service, pumped dry, and were backfilled.

Management of rainwater and cooling water continued to be based on gravity flow offsite to the south. An additional leach bed (LB-1) was constructed to allow for collection and management of these waters.

1959 to 1962

The Aerojet facility continued to grow to the west (i.e., the property previously leased from E.K. Metzner) and east (small residential lots) via property purchases in 1959 and 1961. Additional land bordered on the west by Irwindale Avenue also was leased from E.K. Metzner in 1961. Property on the far southeast corner of the present Aerojet facility was leased from Azusa Rock & Sand from 1961 to 1964 for automobile parking.

Additional facility structure additions and improvements included completion of the Special West Area, expansion of Buildings 57, 59, 159, and 160, construction of Buildings 175 and 183, and improvements and additions to the Proving Grounds and laboratory area. All of this growth occurred in non-rocket motor business areas, with the exception of continued research and development of fuels and related equipment. Other more diversified and high technology operations were being expanded for small-scale research projects.

1963 to 1968

There were few physical changes to the Aerojet-owned and/or Aerojet-occupied facilities during this period. Certain of the properties (on the southwest side of the site) originally leased from E.K. Metzner were purchased in 1967.

The primary change in facility activities during this period was the final transfer of all rocket propellant research and development (R&D) activities to the Sacramento facility in 1968. In 1965, waste solid rocket fuel burning in the Kincaid Pit was discontinued.

1969 to 1972

Beginning in 1968, the evolution of the Aerojet Azusa facility from rocket fuels and rocket motor operations to other high technology research, development, and production was completed. Aerojet's activities at the Azusa facility were then in the electronics field, focusing on research and development of semiconductors and the assembly and testing of space sensors. This evolution was recognized by a name change in 1972 to Aerojet ElectroSystems Company. Of particular note was the demolition, in 1971, of the Proving Grounds and supporting facilities.

1973 to 1991

The Aerojet Azusa facility continued to emphasize electronics-based research, development, and limited production in support of the nation's space program and

other government clients. This period was characterized by a continued reduction in the size of the active areas at the Aerojet Azusa facility.

1992 to Present

Aerojet's emphasis on high technology, computer-based R&D activities, with limited production of scientifically complex products, has continued to the present. This emphasis has continued to result in an associated reduction in solvent and chemical use as compared to earlier periods.

2.3 Identification of Potential Source Areas

On the basis of reviewing the previously listed documents, a list has been developed of the historic operations/locations at the site that are believed to possess the highest likelihood of constituting potential source areas for the emerging chemicals. These locations/features include the following:

Former Drainage Course DG-1 and Leach Bed LB-1, and Former Drainage Course DG-3
Former Leach Beds LB-2 and LB-3
Former Waste Disposal Area WD-1
Former Grinding Stations, Buildings 6/6A and 85
Former Mixing Stations, Buildings 8 and 9
Former Leach Pits LP-1 and LP-2
Former Pilot Plant For UDMH Production Building 103
Former UDMH Distillation Still, Building 15
Former Drum Storage Areas DR-2, 3, 4, 11, and 25c
Former ORC Drum Storage Area DR-6
Former Ponded Liquid Area PL-5
Former Waste Treatment Facilities WT-1 and WT-2
Former Kincaid Burn Pit
Former Day & Night Facility
Former Reichold Chemical Facility
Former 1,1,1-TCA Storage at ORC Building 3

The remainder of this work plan describes the scope of work proposed to investigate each of these areas, and the basis upon which these areas were selected for investigation.

3.0 SCOPE OF WORK

Overview

The areas selected for investigation under this work plan are called out on the attached Figure 1, and are listed on Table 1. Table 1 also lists the proposed boring numbers for each potential source area investigation as called out on Figure 1, and presents the proposed analytical testing program.

Though it is explained more fully in Section 4.0 of this work plan, our approach toward assessing potential sources of the emerging chemicals at the site will consist of collecting relatively undisturbed soil samples, and submitting the samples to a certified laboratory for testing and analysis of the target chemicals. Collecting soil matrix samples for analysis is based on the chemical properties of the emerging chemicals that make assessment by soil-vapor testing unpractical and inappropriate. It is recognized that many of the potential source areas identified were associated with industrial wastes exposed or carried in infiltrating liquids (such as leach beds, drainage courses, leach pits, etc.). Several decades have elapsed since these wastes are assumed to have come into contact with the environment, since these features have been taken out of service or otherwise ceased to exist at the site for many years. As a result, vertical migration may have taken place. Therefore, the source(s) of the emerging chemicals may consist of residual concentrations in shallow soils, or may lie at depth beneath the site. Therefore, based on results from samples obtained from shallower depths, it may be appropriate for additional samples to be collected from deeper intervals in certain areas.

3.1 Former Drainage Course DG-1 and Leach Bed LB-1, and Former Drainage Course DG-3

Former drainage course DG-1 (Figure 1) was located in the south-central portion of the site along the southern edge of the Proving Grounds. The prior documentation indicates that DG-1 controlled runoff from the central area of the site, including a portion of the Proving Ground area, and channeled surface water into drainage Basin B-1 south of the site. The southern portion of DG-1 was located on property leased from Azusa Rock and Sand. Due to continued mining of sand and gravel in the area south of the site, approximately 170 feet of material that once existed below the southern extent of DG-1 has been removed, including former Basin B-1.

Former Leach Bed LB-1 was located proximal to DG-1 to the east. Leach Bed LB-1 was constructed in 1957 to collect surface water runoff in the southern portion of the site. LB-1 was constructed following construction and activation of Aerojet's onsite industrial wastewater treatment facility WT-1. Therefore, the only types of water collected in LB-1 were "once-through" cooling

water, rainwater runoff, and some cooling tower bleed-off water.

DG-3 was located at the southern edge of the western portion of the site. Previous documentation indicates that DG-3 channeled surface water runoff from a portion of relatively undeveloped property owned and/or occupied by Day and Night Manufacturing Company and a limited area of the westernmost site.

Proposed Assessment: One contingent-type deep soil test boring (i.e., sampling at depths of 5, 10, 20 and 30 feet with sampling at deeper depth intervals contingent on results to that level), and two shallow (up to 30 feet deep) test borings at the former locations of both DG-1 and DG-3. Collect relatively undisturbed soil core samples for analysis of target chemicals.

Note: The contingent-type deep soil test boring above shall be positioned in a manner and at a location to provide assessment of both DG-1 and the adjacent Leach Bed LB-1. The proposed location of this test boring is shown on Figure 1.

3.2 Former Leach Beds LB-2 and LB-3

Former Leach Bed LB-2 was located in what is now the southwestern portion of the site (Figure 1). LB-2 consisted of two distinct areas or portions. LB-2 was constructed in approximately 1950 to collect surface water runoff, industrial wastewater, and industrial waste effluents from the storm water collection system. According to the previous documentation, LB-2 would have received diluted wastes from the rocket firing bays, and therefore is may have been a point of exposure of the emerging chemicals to the subsurface.

Proposed Assessment: Two contingent-type deep soil test borings. One will be located in each former leach bed area (Figure 1). Collect relatively undisturbed soil core samples for analysis of target chemicals. We point out that the test boring proposed for the Waste Treatment Facility WT-1 (described in Section 3.12) will also provide data and satisfy assessment objectives relevant to Leach Bed LB-2.

3.3 Former Waste Disposal Area WD-1

The prior documentation indicates that early in Aerojet's history (circa 1945) a portion of the northern portion of the site was used as a rocket motor test area. This rocket test area was located in the vicinity of former Building 119 in the north-central portion of the site. According to the prior documentation, the area identified previously by the EPA (through review of aerial photographs) as Waste Disposal area WD-1 is actually the rocket motor testing area. WD-1 was approximately 250 feet (north-south) by 120 feet (east-west). By 1947, Building 119 had been constructed in the WD-1 area, and all rocket motor testing was being performed in the Proving Grounds area to the south. As a result of these historical activities, this area of the site may have been impacted by perchlorate.

Proposed Assessment: One contingent-type deep soil test boring at the former location of WD-1 (Figure 1). Collect relatively undisturbed soil core samples for analysis of perchlorate.

3.4 Former Grinding Stations

Solid rocket fuels were processed by grinding and/or pulverizing at two locations at the site in former Buildings 6/6A and 85. The former locations of these buildings are indicated on Figure 1.

Proposed Assessment: Two shallow-type test borings each at the locations former Buildings 6/6A and 85 (Figure 1). Collect relatively undisturbed soil core samples at 5, 10, 20, and 30-feet in each boring for analysis of perchlorate.

3.5 Former Solid Propellant Mixing Stations

Historically, rocket fuel was mixed at two locations at the site in former Buildings 8 and 9. The former locations of these buildings are indicated on Figure 1. As a result of these historical activities, this area of the site may have been impacted by perchlorate.

Proposed Assessment: Two shallow-type test borings each at the locations former Buildings 8 and 9 (Figure 1). Collect relatively undisturbed soil core samples at 5, 10, 20, and 30-feet in each boring for analysis of all target chemicals.

3.6 Former Leach Pits LP-1 and LP-2

Former Leach Pit LP-1 occupied an area of about 15 square feet west of Building 16 (Figure 1). Former Leach Pit LP-2 was located approximately 25 feet northwest of Building 40. Information indicates that both LP-1 and LP-2 may have received various organic and inorganic laboratory wastes, including waste potassium perchlorate. These leach pits therefore may

have been points of exposure of the emerging chemicals to the subsurface.

Proposed Assessment: One contingent-type deep soil test boring at the former locations of leach pits LP-1 and LP-2 (Figure 1). Collect relatively undisturbed soil core samples for analysis of all target chemicals.

3.7 Former Pilot Plant For UDMH Production

Historically, the fuel product UDMH was produced in a former pilot plant operation in and near former Building 103 (Figure 1). As a result of these historical activities, this area of the site may have been impacted by NDMA.

Proposed Assessment: One contingent-type deep soil test boring at the location of former Building 103 (Figure 1). Collect relatively undisturbed soil core samples for analysis of NDMA.

3.8 Former UDMH Distillation Unit

A UDMH distillation unit historically existed along the south side of former Building 15. The former location of this building is indicated on Figure 1. As a result of these historical activities, this area of the site may have been impacted by NDMA.

Proposed Assessment: One shallow-type test boring at the approximate location of former Building 15 (Figure 1). Collect relatively undisturbed soil core samples at 5, 10, 20, and 30-feet in each boring for analysis of NDMA.

3.9 Former Drum Storage Areas

Over the years, many drum storage sites existed at the site. These were previously identified and assessed with regard to VOCs in prior investigations. Of the former drum storage areas, a number have been identified as having a likelihood of involving the emerging chemicals. Accordingly, these identified former drum storage areas will be assessed in this investigation. The targeted former drum storage areas are: DR-2, DR-3, DR-4, DR-11, and DR-25c.

Proposed Assessment: One shallow-type soil test boring at the location of each of the former drum storage areas identified above (Figure 1). Collect relatively undisturbed soil core samples at 5, 10, 20, and 30 feet for analysis of all target chemicals.

3.10 Former ORC Drum Storage Area DR-6

Former ORC Drum Storage Area DR-6 was located south of former Building 305 (Figure 1). Previous investigations indicated elevated concentrations of 1,1,1-TCA in soil in this area. As a result of these historical activities, this area of the site may have been impacted by 1,4-dioxane.

Proposed Assessment: Two shallow-type test borings at the location of former Drum Storage Area DR-6. Collect relatively undisturbed soil core samples at 5, 10, 20, and 30-feet in each boring for analysis of 1,4-dioxane.

3.11 Former Ponded Liquid Area PL-5

The area identified in the prior documentation as Ponded Liquid Area PL-5 was located in the southwestern portion of the site south and west of former Building 310. PL-5 consisted of two distinct areas, as shown on Figure 1. The previous information suggests that this feature existed at the site roughly from 1950 to 1955. PL-5 was located near the area of the former Proving Grounds, therefore it is possible that liquids accumulating on the ground surface in this area could have been impacted by area runoff containing NDMA and perchlorate.

Proposed Assessment: One contingent-type deep soil test boring in the main area of PL-5 (Figure 1). Collect relatively undisturbed soil core samples for analysis of all target chemicals.

3.12 Former Waste Treatment Facilities WT-1 and WT-2

WT-1 was located in the south-southwest portion of the site, adjacent to former Building 185, at the western edge of the former Proving Grounds (Figure 1). WT-1 received wastewater from rocket test bays, chemical laboratories, manufacturing and plating facilities and plastics operations. The WT-1 facility was in operation from 1952 to 1971. Wastes collected at WT-1 included various organic chemicals, petroleum based fuels, hydrazine hydrate, organic sludge, detergents, organic salts, mineral acids, inorganic bases and salts, and water.

WT-2 is located in the south-central portion of the site, adjacent to Building 164 (Figure 1). The WT-2 facility has been in operation from 1971 to present, conducting essentially the same operations as were conducted at

former WT-1. However, by the time WT-2 came into operation, rocket fuel operations had ceased at the site. Therefore, WT-2 is considered a potential source for 1,4-dioxane only.

Proposed Assessment: One contingent-type deep soil test boring at the location of each waste treatment facility (Figure 1). Collect relatively undisturbed soil core samples for analysis of all target chemicals.

3.13 Former Kincaid Burn Pit

Historically, solid propellant waste from both Aerojet and Day and Night operations was occasionally disposed by burning in a small area of an open gravel quarry pit north of the site that was leased from the Consolidated Rock Company in 1947 (the "Kincaid" Pit). Solid propellant wastes were collected and taken to the pit for burning. The Kincaid Pit was used in this manner from approximately 1947 until 1965, when solid propellant experimental programs were terminated at the Aerojet Azusa facility.

In 1967, the Kincaid Pit was sold to the State of California by the Consolidated Rock Company, and in 1968 the pit and surrounding area were graded for the construction of Interstate 210. On the basis of historic data, the Kincaid Pit burn area has been identified as a potential source area for perchlorate.

Proposed Assessment: One contingent-type deep soil test boring in the main area of PL-5 (Figure 1). Collect relatively undisturbed soil core samples for analysis of perchlorate.

3.14 Former Day & Night Facility

As previously discussed, the former Day & Night facility was involved in the manufacture of explosive photo-flash bombs for the federal government. These processes involved the handling of perchlorate and NDMA. As a result, this area of the site is a significant concern with regard to possible sources of the emerging chemicals.

Proposed Assessment: Two contingent-type deep soil test borings in the main area of the former Day & Night facility on the west side of the site (Figure 1). Collect relatively undisturbed soil core samples for analysis of all target chemicals.

3.15 Former Reichold Chemical Facility

The former Reichold Chemical facility in the southwest portion of the site is a concern as a possible source for the chemical 1,4-dioxane due to its association with the solvent 1,1,1-TCA, which was used extensively at the former Reichold facility.

Proposed Assessment: One contingent-type deep soil test boring in the area of the former Reichold Chemical facility in the southwest portion of the site (Figure 1). Collect relatively undisturbed soil core samples for analysis of 1,4-dioxane.

3.16 Former TCA Storage Area at ORC Facility

Prior investigations suggest that prior storage and use of the solvent 1,1,1-TCA by ORC along the south side of Building 3 (Figure 1) may be a possible source of 1,4-dioxane to soils in that area. Previously, 1,1,1-TCA was stored in a drum storage area and a 1,500-gallon above ground tank. A degreaser was also used in this building. Accordingly, this location is considered a possible source for the emerging chemical, 1,4-dioxane.

Proposed Assessment: One contingent-type deep soil test boring at the location of the former degreaser (Figure 1). Collect relatively undisturbed soil core samples for analysis of 1,4-dioxane.

4.0 FIELD INVESTIGATION METHODS

4.1 Drilling and Sample Collection Methods

Soil matrix samples will be collected from the contingent-type deep interval test borings drilled initially (i.e., to a depth of 30 feet) using hollow-stem auger drilling method. However, if, based on the test results in the shallow interval to that point, deeper drilling and sampling is appropriate, these borings will be extended to deeper levels. Deeper drilling will be accomplished using mud rotary drilling technique. It is currently planned that soil matrix samples will be collected from the deeper intervals using a Christensen® 94mm coring tool, or similar device that will yield relatively undisturbed core samples. It is believed that this technique presents the best likelihood of achieving the desired sample depths while preserving the integrity of the samples collected. The coring tool will produce relatively undisturbed soil cores unaffected

by the drilling fluid. Once the coring tool is removed, the drilled core will be retrieved, examined, logged and screened in the field for VOC vapors using a field photoionization detector (PID). Sections from the undisturbed soil core will then be collected and placed into sample jars, and delivered to the on-site laboratory for testing of the organic chemicals, NDMA and 1,4-dioxane. It is currently planned that testing for perchlorate will be performed off site in a fixed laboratory. However, if appropriate accommodation can be made to perform this testing in the field as well, we will seek to include this analyte in our field testing program.

The shallow test borings will be accomplished using hollow-stem auger drilling methods. Driven-type samples will be collected from these borings using a standard split-spoon sampling device. These samples will be collected in brass sample sleeves housed inside the split-spoon sampler. Upon removal from the sampler, the samples will be screened, logged, fitted with plastic end caps and delivered immediately to the on-site lab for testing.

Because analytical testing will be performed in the field for NDMA and 1,4-dioxane, it is planned that final boring completion depths can be determined in the field based on analytical test results available to site personnel. Similarly, analytical testing for perchlorate will also be performed in the field provided a suitable analytical methodology is identified. For instance, in the case of the deep (250') test borings, if field results show no detectable NDMA and 1,4-dioxane (and perchlorate, if appropriate) through the first 100 feet of drilling and sampling, we would propose termination of those borings at that depth. Similarly, if at least two samples at the bottom of any boring produces indicate non-detectable results, we will conclude that the extent of contamination has been defined and the boring will be terminated at that depth. We anticipate that these types of field decisions will be made in consultation with RWQCB personnel.

4.2 Sample Handling and Laboratory Testing

As mentioned, it is anticipated that all soil samples collected will be analyzed for NDMA and 1,4-dioxane in a California state-certified on-site mobile laboratory. Testing for perchlorate will be accomplished in a fixed laboratory. Once collected, samples will be placed into proper sample jars supplied by the lab. Samples will be logged, visually examined, labeled, and delivered to the on-site lab under all applicable chain-of-custody protocol requirements. As necessary, samples will be maintained in properly chilled sample containers, pending analysis.

Soil samples collected for analysis of NDMA will be tested according to EPA Test Method 8270C,modified to achieve a detection limit of 20 ppb. Ten grams of soil will be extracted with 10 ml of methylene chloride/acetone solvent according to EPA Method 3550 (Ultrasonic Extraction) and reduced in volume to 1 ml. A gas chromatograph/mass spectrometer system equipped with a large volume injector (LVI) will be used to achieve the reduced detection limit.

Samples collected for analysis of 1,4-dioxane will be tested according to EPA Test Method 8260B, also with a MDL of 20 ppb. Samples collected for analysis of perchlorate will be tested using ion chromatography.

4.3 Waste Management

Waste soil cuttings from drilling activities will be contained in appropriate bins. Wastewater from decontamination activities will be contained in 55-gallon steel drums. These waste containers will be staged at the Aerojet site at an appropriate location pending proper off-site transport and disposal.

4.4 Health and Safety

Prior to commencement of field activities, a project-specific Health and Safety Plan (HSP) will be prepared to guide field work at the site. A field copy of the HSP will be maintained at the work site during all field activities. The HSP will identify potential health and safety hazards associated with the field activities, outline general safe work practices for personnel at the site, define personal protective equipment requirements, and describe specific measures to be undertaken in case of an emergency. As necessary, morning "tailgate" safety meetings will be conducted with work crews by the field safety officer to review procedures and job requirements. Personnel involved in the field activities will be required to review, understand, and comply with the HSP prior to conducting work at the site. It is anticipated that all field work will be performed under Level "D" personal protective equipment requirements.

4.5 Permitting and Utility Clearance

Prior to performing any intrusive work at the site, any required drilling permits will be obtained from the Los Angeles County Department of Environmental Health. Also, in accordance with state regulations, Underground

Service Alert (USA) will be notified of the impending drilling activities 48-hours prior to field implementation.

5.0 SCHEDULE AND IMPLENENTATION

It is estimated that field work can begin approximately 30 days following RWQCB approval of this work plan, and resolution of all required off-site property access agreements. A report of this investigation can be delivered to the RWQCB within 60 days following completion of the field work and receipt of all laboratory test data.

In order to manage the cost of this investigation, it is proposed that the field effort be conducted in two separate phases. The first phase of the investigation will target the potential sources of highest likelihood of impact from the emerging chemicals. This includes the Leach Pits, Leach Beds, Drainage Courses, Waste Treatment facilities, and the Kincaid Burn Pit. Should results of sampling from these primary suspected source areas suggest that emerging chemicals are not present in significant concentrations, consideration will be given to reducing the overall scope of the remainder of the investigation at other secondary suspected sources. Should this situation occur, it is anticipated that Aerojet will work with the RWQCB at that point to ensure a satisfactory and equitable resolution.

Table 1 shows how the two investigation phases will be divided, and indicates which borings will be performed in each phase of field work.

TABLES

Table 1
Summary of Proposed Field Investigation and Sample Analysis

Identified Potential Source Area	Boring Numbers (Reference Figure 1)	*SHALLOW BORINGS* Shallow Borings Up To 30 feet	Number of Samples	*CONTINGENT DEEP BORINGS* Deep Borings Up To 250 feet	Number of Samples	*LABORATOTY TESTING* NDMA Analyses	Perchlorate Analyses	1,4-Dioxane Analyses
Phase I Investigation								
Former Drainage Course DG-1	PSZB-01/02, PDZB-01	2	8	1	8	16	16	16
Former Drainage Course DG-3	PSZB-03/04, PDZB-02	2	8	1	8	16	16	16
Former Leach Bed LB-2	PDZB-03	---	---	1	8	8	8	8
Former Leach Bed LB-3	PDZB-04	---	---	1	8	8	8	8
Former Leach Pit LP-1	PDZB-06	---	---	1	8	8	8	8
Former Leach Pit LP-2	PDZB-07	---	---	1	8	8	8	8
Former Kincaid Burn Pit	PDZB-12	---	---	1	8	---	8	---
Phase II Investigation								
Former Pilot Plant For UDMH Production, Building 103	PDZB-08	---	---	1	8	8	---	---
Former UDMH Distillation Unit, Building 15	PSZB-13	1	4	---	---	4	---	---
Former Drum Storage Areas DR-2, DR-3, DR-4, DR-11, DR-25c	PSZB-14/18	5	20	---	---	20	20	20
Former Waste Disposal Area WD-1	PDZB-05	---	---	1	8	---	8	---
Former ORC Drum Storage Area DR-6	PSZB-19, PDZB-13	2	8	---	---	---	---	8
Former Ponded Liquid Area PL-5	PDZB-9	---	---	1	8	8	8	8
Former Waste Treatment Facilities WT-1 and WT-2	PDZB-10/11	---	---	2	16	16	16	16
Former Grinding Stations, Buildings 6/6A and 85	PSZB-05/06	4	16	---	---	---	16	---
Former Solid Propellant Mixing Stations, Buildings 8 and 9	PSZB-09/12	4	16	---	---	---	16	---
Former Day & Night Facility	PDZB-14/15	---	---	2	16	16	16	16
Former Reichold Chemicals Facility	PDZB-16	---	---	1	8	---	---	8
Former 1,1,1-TCA Storage at ORC Building 3	PDZB-13	---	---	1	8	---	---	8
TOTAL NUMBER OF BORINGS/SAMPLES		20	80	16	128	136	172	148

Sample intervals in shallow borings @ 5, 10, 20, 30 ft bgs
Sample intervals in the contingent deep borings @ 5, 10, 20, 30, 100, 150, 200, 250 ft bgs; ***sampling beyond 30' shall be contingent on results to that point***
--- Not included in asessment

FIGURES

PARTIALLY SCANNED
OVERSIZE ITEM (S)

See Document # 95458
for partially scanned image(s).

For complete version of oversize document(s),
see paper copy.